STATEMENT OF BASIS

Applicant:	U.S. Geological Survey Earth Resources Observation and Science (EROS) Data Center
Permit Number:	SD0000299
Contact Person:	Bruce Potter, Facility Manager Rod Beck, Project Manager O&M 47914, 252nd Street Sioux Falls, SD 57198
Phone:	(605) 594-6199- Project Manager (605) 594-6081- Facility Manager
Permit Type:	Major Facility - Renewal

This document is intended to explain the basis for the requirements contained in the proposed Surface Water Discharge Permit. This document provides guidance to aid in complying with the permit regulations. This guidance is not a substitute for reading the proposed permit and understanding its requirements.

DESCRIPTION

The National Center for Earth Resources Observation and Science (EROS) operates a wastewater treatment facility located about 13 miles northeast of the city of Sioux Falls, in the South ½ of Section 8, Township 103 North, Range 48 West, in Minnehaha County, South Dakota (Latitude 43.737611°, Longitude -96.620694° – Navigational Quality GPS).

The facility collects and distributes data from a series of satellites. The facility operates with around 650 employees and treats about 14,000 gallons per day (gpd) of sanitary and domestic wastewater. Previously, the facility also discharged about 2,000 gpd of photo wash water and about 40 gpd of photographic chemical waste. However, the facility removed the chemistry lab in 2005; as a result, photographic chemicals are no longer part of the wastewater.

The wastewater treatment facility began operation in 1973 and consists of a five-cell stabilization pond system with one lift station located inside the building, which serves two bathrooms. Influent flow is measured by three separate Parshall flumes. Cell #1 is 0.73 acres and contains two surface aeration units, which are jet-type aerators that blow air down below the surface of the pond. Cell #2 is 0.39 acres and is used for sedimentation. Cells #3 and #4 are used as polishing ponds and are 1.80 and 1.95 acres, respectively. Cell #5 was created by the construction of a dam by USGS and is not surrounded by berms to prevent runoff into the cell. Cell #5 acts as a polishing pond that is 14.22 acres in size. Effluent from cell #5 is controlled using a valved siphon. The effluent flow is measured using a 90° V-notch weir.

The ponds are operated in series under normal operation, however the facility has the ability to bypass each individual pond and the ability to bypass directly to the last pond. The total capacity of the wastewater treatment facility is 32 million gallons.

RECEIVING WATERS

Any discharge from this facility will enter an unnamed tributary of West Pipestone Creek. The unnamed tributary is currently classified by the South Dakota Surface Water Quality Standards (SDSWQS), Administrative Rules of South Dakota (ARSD), Sections 74:51:03:01 and 74:51:03:07 for the following beneficial uses:

(5) Warmwater semipermanent fish life propagation;
(8) Limited-contact recreation waters;
(9) Fish and wildlife propagation, recreation, and stock watering waters; and
(10) Irrigation waters.

The unnamed tributary flows about four miles before reaching West Pipestone Creek. West Pipestone Creek is currently classified by the South Dakota Surface Water Quality Standards (SDSWQS), Administrative Rules of South Dakota (ARSD), Sections 74:51:03:01 and 74:51:03:07 for the following beneficial uses:

(6) Warmwater marginal fish life propagation;
(8) Limited-contact recreation waters;
(9) Fish and wildlife propagation, recreation, and stock watering waters; and
(10) Irrigation waters.

West Pipestone Creek then flows another four miles before entering Split Rock Creek. Split Rock Creek is classified by the SDSWQS, ARSD Sections 74:51:03:01 and 74:51:03:07 for the following beneficial uses:

(5) Warmwater semipermanent fish life propagation;
(7) Immersion recreation waters;
(8) Limited-contact recreation waters;
(9) Fish and wildlife propagation, recreation, and stock watering waters; and
(10) Irrigation waters.

ANTIDEGRADATION

South Dakota Department of Environment and Natural Resources (SDDENR) has fulfilled the antidegradation review requirements for this permit. In accordance with South Dakota's Antidegradation Implementation Procedure and the SDSWQS, no further review is required. The results of SDDENR's review are included in Attachment 1.

MONITORING DATA

EROS has been submitting Discharge Monitoring Reports (DMRs) as required under the current permit. In June 2011, EROS was approved to submit electronic DMRs. In April 2011, the facility reported exceeding the 30-day average for Weak Acid Dissociable (WAD) Cyanide. Because of the test method used, this result could have been a false positive caused by interference by nitrate in agricultural runoff into the final cell. This is not considered a violation. To prevent further possible

interference with the WAD Cyanide tests, SDDENR will be requiring the facility to test for WAD Cyanide using either the OIA- 1677 or the Kelada 01 test method because these test methods will not give false readings because of nitrates. See attachment 2 for a summary of reported discharge data. The facility reported "No discharge" for the months not included in the table.

INSPECTIONS

Personnel from SDDENR conducted a Compliance inspection of the wastewater treatment facility on May 27, 2010. No deficiencies were noted during the inspection.

EFFLUENT LIMITS – *Outfall 001*

SDDENR is required by EPA and the federal Clean Water Act to review and revise its surface water quality standards at least every three years. On March 11, 2009, the South Dakota Board of Water Management approved SDDENR's latest triennial review of the South Dakota Surface Water Quality Standards. As part of this review, SDDENR added surface water quality standards for *Escherichia coli* (*E. coli*). ARSD Section 74:51:01:51 includes numeric criteria for both fecal coliform and *E. coli*. SDDENR intends to phase in the implementation of the *E. coli* standards.

During the reissuance of surface water discharge permits, permittees that are currently required to meet fecal coliform limits will be given time to meet the new *E. coli* limits. Therefore, interim limits for fecal coliform will be initially included in the proposed permit, with a requirement to meet the new *E. coli* limits by May 1, 2014.

Outfall 001 – Any discharge from the V-notch Weir in Cell #5 to an unnamed tributary of West Pipestone Creek (Latitude 43.735111°, Longitude -96.614417°, Navigational Quality GPS).

Interim Effluent Limits
Effective immediately and lasting until **April 30, 2014**, the permittee shall comply with the interim effluent limits below.

No discharge shall occur from this facility until the facility has shown no toxicity is detected by obtaining and analyzing a valid acute whole effluent toxicity sample and receives permission to discharge from SDDENR. This requirement is included in the permit because the discharge reaches a stream classified as a fishery and the facility is classified as a Major Facility. During any discharge, the permittee shall comply with the effluent limits specified below, which are based on the SDSWQS, Best Professional Judgment (BPJ), and the current permit limits.

1. The Five-day Biochemical Oxygen Demand (BOD_5) concentration shall not exceed 20 mg/L (daily maximum). This limit is based on the current permit limit and BPJ in order to prevent backsliding.

2. The Total Suspended Solids (TSS) concentration shall not exceed 30 mg/L (daily maximum). This limit is based on the current permit limit and BPJ in order to prevent backsliding.

3. The pH shall not be less than 6.5 standard units or greater than 9.0 standard units in any single analysis and/or measurement. These limits are based on the warmwater semipermanent fish life propagation classification of the unnamed tributary of West Pipestone Creek.

   Note: SDDENR specifies that pH analyses are to be conducted within 15 minutes of sample collection with a pH meter. Therefore, the permittee must have the ability to conduct onsite pH analyses. The pH meter used must be capable of simultaneous calibration to two points on the pH scale that bracket the expected pH and are approximately three standard units apart. The pH meter must read to 0.01 standard units and be equipped with temperature compensation adjustment. Readings shall be reported to the nearest 0.1 standard units.

4. The WAD cyanide concentration shall not exceed 8 µg/L (30-day average). This limit is based on the current permit limit in order to prevent backsliding.

   In addition, WAD cyanide shall not exceed 58.8 µg/L (daily maximum). This limit is based on the current permit limit and the Total Daily Maximum Load (TMDL) developed for the West Pipestone Creek. The TMDL was based on the minimum 7-day average low flow that can be expected to occur once every five years (7Q5) for West Pipestone Creek; the background metals concentration; the background hardness of water in the West Pipestone Creek; the SDSWQS (ARSD Section 74:51:01:55), and BPJ.

5. Fecal Coliform organisms from May 1 to September 30 shall not exceed a concentration of 1,000 per 100 milliliters as a geometric mean based on a minimum of five samples obtained during separate 24-hour periods for any 30-day period. *This limit is applicable only if five or more samples are taken and is only effective from May 1 to September 30.*

   In addition, fecal coliform organisms shall not exceed 2,000 per 100 milliliters in any one sample from May 1 to September 30. These limits are based on the limited contact recreation waters classification of unnamed tributary of West Pipestone Creek and the SDSWQS (ARSD Section 74:51:01:51).

6. The ammonia-nitrogen concentration shall not exceed the limits specified in the table below. These limits are based on the warmwater semipermanent fish life propagation waters classification of the unnamed tributary of West Pipestone Creek, the SDSWQS (ARSD Section 74:51:01:48), the current permit limits, and BPJ. See Attachment 3 for more detail.

Month	Ammonia Limit (as N)	
	30-Day Average (mg/L)	Daily Maximum (mg/L)
January 1 – January 31	5.6	12.6
February 1 – February 29	5.6	12.6
March 1 – March 31	4.2	12.6
April 1 – April 30	3.2	10.3
May 1 – May 31	1.2	9.5
June 1 – June 30	1.2	9.5
July 1 – July 31	1.2	9.5
August 1 – August 31	1.2	8.0
September 1 – September 30	1.2	9.5
October 1 – October 31	1.2	9.5
November 1 – November 30	5.2	10.3
December 1 – December 31	5.6	12.6

7. There shall be no Acute Toxicity, as measured by the Whole Effluent Toxicity test. This limit is based on the SDSWQS (ARSD Section 74:51:01:12), and the current permit.

8. Oil and Grease concentrations shall not exceed 10 mg/L nor impart a visible film or sheen to the surface of the water or to the adjoining shorelines. These limits are based on the fish and wildlife propagation, recreation, and stock watering waters classifications of the unnamed tributary of West Pipestone Creek and the SDSWQS (ARSD Sections 74:51:01:10 and 74:51:01:52).

9. No chemicals, such as chlorine, shall be used without prior written permission. This limit is based on BPJ.

Effluent water temperature (°C), flow rate (million gallons/day, MGD), total flow (million gallons), duration of discharge (days), Chemical Oxygen Demand (COD, mg/L), and *E. coli* (no./100mL) shall be monitored, but will not have a limit.

Final Effluent Limits

Effective **May 1, 2014**, and lasting through the life of the permit, the permittee shall comply with the final effluent limits below.

No discharge shall occur from this facility until the facility has shown no toxicity is detected by obtaining and analyzing a valid acute whole effluent toxicity sample and receives permission to discharge from SDDENR. This requirement is included in the permit because the discharge reaches a stream classified as a fishery and the facility is classified as a Major Facility. During any discharge, the permittee shall comply with the effluent limits specified below, which are based on the SDSWQS, Best Professional Judgment (BPJ), and the current permit limits.

1. The Five-day Biochemical Oxygen Demand (BOD_5) concentration shall not exceed 20 mg/L (daily maximum). This limit is based on the current permit limit and BPJ in order to prevent backsliding.

2. The Total Suspended Solids (TSS) concentration shall not exceed 30 mg/L (daily maximum). This limit is based on the current permit limits and BPJ in order to prevent backsliding.

3. The pH shall not be less than 6.5 standard units or greater than 9.0 standard units in any single analysis and/or measurement. These limits are based on the warmwater semipermanent fish life propagation classification of the unnamed tributary of West Pipestone Creek.

   Note: SDDENR specifies that pH analyses are to be conducted within 15 minutes of sample collection with a pH meter. Therefore, the permittee must have the ability to conduct onsite pH analyses. The pH meter used must be capable of simultaneous calibration to two points on the pH scale that bracket the expected pH and are approximately three standard units apart. The pH meter must read to 0.01 standard units and be equipped with temperature compensation adjustment. Readings shall be reported to the nearest 0.1 standard units.

4. The WAD cyanide concentration shall not exceed 8 µg/L (30-day average). This limit is based on the current permit in order to prevent backsliding.

   In addition, WAD cyanide shall not exceed 58.8 µg/L (daily maximum). This limit is based on the current permit limit and the Total Daily Maximum Load (TMDL) developed for the West Pipestone Creek. The TMDL was based on the minimum 7-day average low flow that can be expected to occur once every five years (7Q5) for West Pipestone Creek; the background metals concentration; the background hardness of water in the West Pipestone Creek; the SDSWQS (ARSD Section 74:51:01:55, and BPJ.

5. The *Escherichia coli* (*E. coli*) organisms shall not exceed a concentration of 630 per 100 milliliters as a geometric mean based on a minimum of five samples obtained during separate 24-hour periods for any 30-day period. *This limit is only applicable if five or more samples are taken and is only effective from May 1 to September 30.*

   In addition, the *E. coli* organisms shall not exceed 1,178 per 100 milliliters in any one sample from May 1 to September 30. These limits are based on the limited contact recreation waters classification of unnamed tributary of West Pipestone Creek and the SDSWQS (ARSD Section 74:51:01:51).

6. The ammonia-nitrogen concentration shall not exceed the limits specified in the table below. These limits are based on the warmwater semipermanent fish life propagation waters classification of the unnamed tributary of West Pipestone Creek, the SDSWQS (ARSD Section 74:51:01:48), the current permit limits, and BPJ. See Attachment 3 for more detail.

Month	Ammonia Limit (as N)	
	30-Day Average (mg/L)	Daily Maximum (mg/L)
January 1 – January 31	5.6	12.6
February 1 – February 29	5.6	12.6
March 1 – March 31	4.2	12.6
April 1 – April 30	3.2	10.3
May 1 – May 31	1.2	9.5
June 1 – June 30	1.2	9.5
July 1 – July 31	1.2	9.5
August 1 – August 31	1.2	8.0
September 1 – September 30	1.2	9.5
October 1 – October 31	1.2	9.5
November 1 – November 30	5.2	10.3
December 1 – December 31	5.6	12.6

7. There shall be no Acute Toxicity, as measured by the Whole Effluent Toxicity test. This limit is based on the SDSWQS (ARSD Section 74:51:01:12), the current permit, and the settlement agreement.

8. Oil and Grease concentrations shall not exceed 10 mg/L daily maximum) nor impart a visible film or sheen to the surface of the water or to the adjoining shorelines. These limits are based on the fish and wildlife propagation, recreation, and stock watering waters classifications of the unnamed tributary of West Pipestone Creek, the SDSWQS (ARSD Section 74:51:01:52 and 74:51:01:10).

9. No chemicals, such as chlorine, shall be used without prior written permission. This limit is based on BPJ.

Effluent water temperature (°C), flow rate (MGD), total flow (million gallons), duration of discharge (days), Chemical Oxygen Demand (COD, mg/L), and Hardness (as $CaCO_3$, mg/L) shall be monitored, but will not have a limit.

SELF-MONITORING REQUIREMENTS

Reasonable Potential Analysis

The facility was required to monitor for chemicals under its current permit. Because the facility has ceased using photographical chemicals, SDDENR conducted an analysis of the photographic chemicals in the effluent collected by the facility to determine if there is a reasonable potential for the facility to violation the SDSWQS (See attachment 6). The analysis indicated possible elevated levels of weak acid dissociable (WAD) cyanide. The WAD cyanide limits will remain in the proposed permit.

The remaining chemicals from the photographic process that have limits in the current permit (cadmium, chromium, silver, and zinc) did not show a reasonable potential to violate the

SDSWQS and will not be required to be monitored in the proposed permit. Aluminum, boron, bromide, formaldehyde, iron, and phenols did not have limits in the current permit, are not expected in the effluent, therefore these will not be required to be monitored in the proposed permit. The SDSWQS for cadmium, silver, and zinc are based on the hardness levels in the discharge and in the stream. To determine if there was a reasonable potential to violate the SDSWQS for these parameters, the average hardness of the effluent as reported by EROS (252 mg/L), was used in the analysis. No degradation of the stream is expected as a result of removing the effluent limits or monitoring for these photographical chemicals.

Total Residual Chlorine monitoring will be removed in the proposed permit because the facility does not chlorinate the effluent and will not be allowed to use chemicals such as chlorine without prior written permission from SDDENR.

Interim Effluent Monitoring Requirements

As a minimum, upon the effective date of this permit and lasting through **April 30, 2014**, the following parameters shall be monitored at the frequency and with the type of measurement indicated; samples or measurements shall be representative of the volume and nature of the monitored discharge.

Effluent Characteristic	**Frequency**	**Reporting Values** [1]	**Sample Type** [1]
Flow Rate, (MGD)	Three per discharge [2]	Daily Maximum; 30-Day Average	Instantaneous
pH, standard units	Three per discharge [2, 3]	Daily Minimum; Daily Maximum	Instantaneous [4]
Water Temperature, °C	Three per discharge [2, 4]	Daily Maximum; 30-Day Average	Instantaneous [5]
Chemical Oxygen Demand (COD), mg/L	Three per discharge [2]	Daily Maximum	Grab
Five-day Biochemical Oxygen Demand (BOD_5), mg/L	Three per discharge [2]	Daily Maximum	Grab
Ammonia-Nitrogen (as N), mg/L	Three per discharge [2, 4]	Daily Maximum; 30-Day Average	Grab [3]
Total Suspended Solids (TSS), mg/L	Three per discharge [2]	Daily Maximum	Grab
Fecal Coliform, no./100 mL	Three per discharge [2, 6]	Daily Maximum; 30-Day Geo Mean	Grab
E. coli, no./100 mL	Three per discharge [2, 6]	Daily Maximum; 30-Day Geo Mean	Grab
Oil and Grease, visual	Daily during a discharge	Presence or absence of sheen	Visual [7]
Oil and Grease (hexane ext), mg/L [8]	Contingent	Daily Maximum	Grab

Effluent Characteristic	Frequency	Reporting Values [1]	Sample Type [1]
Weak Acid Dissociable (WAD) Cyanide, µg/L [9]	One per discharge	Daily Maximum; 30-Day Average	Grab
Total flow, million gallons	Monthly	Monthly Total	Calculated
Duration of Discharge Days	Monthly	Monthly Total [10]	Calculated
Acute Whole Effluent Toxicity, TUa	Quarterly [11]	Pass/fail; Actual Value	Grab

[1] See Definitions in the proposed permit.

[2] A minimum of three samples shall be taken during any discharge. A sample shall be taken at the beginning, middle, and end of the discharge if the discharge is less than one week in duration. If a single, continuous discharge is greater than one week in duration, three samples shall be taken the first week and one each following week. All samples collected during the 7-day or 30-day period shall be used in determining the averages. The permittee always has the option of collecting additional samples if appropriate.

[3] The pH and temperature of the effluent shall be determined when ammonia samples are collected.

[4] The pH shall be taken within 15 minutes of sample collection with a pH meter. The pH meter must be capable of simultaneous calibration to two points on the pH scale that bracket the expected pH and are approximately three standard units apart. The pH meter must read to 0.01 standard units and be equipped with temperature compensation adjustment. Readings shall be reported to the nearest 0.1 standard units.

[5] The water temperature of the effluent shall be taken as a field measurement. Measurement shall be made with a mercury-filled, or dial type thermometer, or a thermistor. Readings shall be reported to the nearest whole degree Celsius.

[6] If a minimum of five samples are collected in a calendar month, all of the samples collected are to be used in determining the geometric mean. Samples are to be collected at the same time as BOD_5, TSS, etc. If less than five samples are taken during any calendar month, the maximum limit still applies. ***This sampling protocol for fecal coliform and* E. coli *only applies if the discharge occurs between May 1 and September 30.***

[7] In the event a sheen is observed in the discharge, a grab sample shall be immediately taken and analyzed for oil and grease (hexane ext.). The results of the sampling shall be reported to the department.

[8] A grab sample shall be taken if a visual sheen is observed and a concentration shall be determined using EPA method 1664A oil and grease hexane extraction.

[9] The WAD cyanide shall be tested using either the OIA- 1677 or Kelada 01 test methods.

[10] The date and time of the start and termination of each discharge shall also be reported in the comment section of the DMR.

[11] The Acute Whole Effluent Toxicity Test shall be taken prior to discharge. If the discharge lasts three consecutive months or longer, quarterly WET tests shall be conducted.

Final Effluent Monitoring Requirements

Effective **May 1, 2014**, and lasting through the life of the permit, the permittee shall comply with the final effluent limits below; samples or measurements shall be representative of the volume and nature of the monitored discharge.

Effluent Characteristic	Frequency	Reporting Values [1]	Sample Type [1]
Flow Rate, MGD	Three per discharge [2]	Daily Maximum; 30-Day Average	Instantaneous
pH, standard units	Three per discharge [2, 3]	Daily Minimum; Daily Maximum	Instantaneous [4]
Water Temperature, °C	Three per discharge [2, 4]	Daily Maximum; 30-Day Average	Instantaneous [5]
Chemical Oxygen Demand (COD), mg/L	Three per discharge [2]	Daily Maximum	Grab
Five-day Biochemical Oxygen Demand (BOD_5), mg/L	Three per discharge [2]	Daily Maximum	Grab
Ammonia-Nitrogen (as N), mg/L	Three per discharge [2, 4]	Daily Maximum; 30-Day Average	Grab [3]
Total Suspended Solids (TSS), mg/L	Three per discharge [2]	Daily Maximum	Grab
E. coli, no./100 mL	Three per discharge [2, 6]	Daily Maximum; 30-Day Geo Mean	Grab
Oil and Grease, visual	Daily during a discharge	Presence or absence of sheen	Visual [7]
Oil and Grease (hexane ext), mg/L [8]	Contingent	Daily Maximum	Grab
Weak Acid Dissociable (WAD) Cyanide, µg/L [9]	One per discharge	Daily Maximum; 30-Day Average	Grab
Acute Whole Effluent Toxicity, TUa	Quarterly [10]	Pass/fail; Actual Value	Grab
Total flow (million gallons)	Monthly	Monthly Total	Calculated
Duration of Discharge (Days)	Monthly	Monthly Total [11]	Calculated

[1] See Definitions in the proposed permit.

[2] A minimum of three samples shall be taken during any discharge. A sample shall be taken at the beginning, middle, and end of the discharge if the discharge is less than one week in duration. If a single, continuous discharge is greater than one week in duration, three samples shall be taken the first week and one each following week. All samples collected during the 7-day or 30-day period shall be used in determining the averages. The permittee always has the option of collecting additional samples if appropriate.

[3] The pH and temperature of the effluent shall be determined when ammonia samples are collected.

[4] The pH shall be taken within 15 minutes of sample collection with a pH meter. The pH meter must be capable of simultaneous calibration to two points on the pH scale that bracket the expected pH and are approximately three standard units apart. The pH meter must read to 0.01 standard units and be equipped with temperature compensation adjustment. Readings shall be reported to the nearest 0.1 standard units.

[5] The water temperature of the effluent shall be taken as a field measurement. Measurement shall be made with a mercury-filled, or dial type thermometer, or a thermistor. Readings shall be reported to the nearest whole degree Celsius.

[6] If a minimum of five samples are collected in a calendar month, all of the samples collected are to be used in determining the geometric mean. Samples are to be collected at the same time as BOD_5, TSS, etc. If less than five samples are taken during any calendar month, the maximum limit still applies. ***This sampling protocol for* E. coli *only applies if the discharge occurs between May 1 and September 30.***

[7] In the event a sheen is observed in the discharge, a grab sample shall be immediately taken and analyzed for oil and grease (hexane ext.). The results of the sampling shall be reported to the department.

[8] A grab sample shall be taken if a visual sheen is observed and a concentration shall be determined using EPA method 1664A oil and grease hexane extraction.

[9] The WAD cyanide shall be tested using either the OIA- 1677 or Kelada 01 test methods.

[10] The Acute Whole Effluent Toxicity Test shall be taken prior to discharge. If the discharge lasts three months or longer, quarterly WET tests shall be conducted.

[11] The date and time of the start and termination of each discharge shall also be reported in the comment section of the DMR.

Reporting

Effluent monitoring results shall be summarized for each month and recorded on separate DMRs to be submitted to SDDENR on a **monthly** basis. If no discharge occurs during a month, it shall be stated as such on the DMR.

Inspections

Monitoring shall consist of **monthly** inspections of the facility and the outfall to verify that proper operation and maintenance procedures are being practiced and whether or not there is a discharge occurring from this facility. **Daily** inspections are required during a discharge. The lift station shall be inspected on at least a **weekly** basis, although **daily** inspections are recommended. Documentation of each of these visits shall be kept in a notebook to be reviewed by SDDENR or EPA personnel when an inspection occurs.

WHOLE EFFLUENT TOXICITY TESTING

The permittee shall sample and test for Acute Whole Effluent Toxicity (WET) before a discharge occurs in accordance with the proposed permit. If toxicity occurs, the facility shall not discharge. If a discharge lasts longer than three months, an acute WET test must be performed on a quarterly basis. SDDENR is moving towards switching from a WET limit of Pass/Fail to Toxic Units (TUa = Acute Toxic Units, TUc = Chronic Toxic Units). One of the advantages to switching to TU's is that it will allow labs, facilities, and SDDENR to use statistics to help eliminate false negatives and false positives, providing more accurate results. Therefore, in this permit cycle, the facility will be required to report in both Pass/Fail and TUa.

SLUDGE

Based on EROS's permit application, SDDENR does not anticipate sludge will be removed or disposed of during the life of the permit. Therefore, the proposed Surface Water Discharge permit shall not contain sludge disposal requirements. However, if sludge disposal is necessary, EROS is required to submit to the Waste Management program of SDDENR a sludge disposal plan for review and approval **prior** to the removal and disposal of sludge.

DRAINAGE ISSUES

Minnehaha County has the authority to regulate drainage. EROS is responsible for getting any necessary drainage permits from the county **prior** to discharging.

ENDANGERED SPECIES

This is a renewal of an existing permit. No listed endangered species are expected to be impacted by activities related to this permit. However, the table below shows the species that may be present in EROS's geographic area.

COUNTY	GROUP	SPECIES	CERTAINTY OF OCCURRENCE	STATUS
MINNEHAHA	FISH	SHINER, TOPEKA	KNOWN	ENDANGERED

This information was accessible at the following US Fish and Wildlife Service website as of August 9, 2012: http://www.fws.gov/southdakotafieldoffice/SpeciesByCounty.pdf.

PERMIT EXPIRATION

A five-year permit is recommended.

PERMIT CONTACT

Any questions pertaining to this statement of basis can be directed to Jonathan Hill, Engineer II, for the Surface Water Quality Program, at (605) 773-3351.

August 29, 2012

ATTACHMENT 1

Antidegradation Review

Permit Type: **Minor Municipal - Renewal** Applicant: **USGS National Center for Earth Resources Observation Science**

Date Received: **11/25/2009** Permit #: **SD0000299**

County: **Minnehaha** Legal Description: **South ½ Sec 8, T103N, R48W**

Receiving Stream: **unnamed tributary of West Pipestone Creek** Classification: **5, 8, 9, 10**

If the discharge affects a downstream waterbody with a higher use classification, list its name and uses: **Split Rock Creek: 5, 7, 8, 9, 10**

APPLICABILITY

1. Is the permit or the stream segment exempt from the antidegradation review process under ARSD 74:51:01? Yes ☒ No ☐ If no, go to question #2. If yes, check those reasons why the review is not required:

☐ Existing facility covered under a surface water discharge permit is operating at or below design flows and pollutant loadings;

☐ *Existing effluent quality from a surface water discharge permitted facility is in compliance with all discharge permit limits;

☐ *Existing surface water discharge permittee was discharging to the current stream segment prior to March 27, 1973, and the quality and quantity of the discharge has not degraded the water quality of that segment as it existed on March 27, 1973;

☐ *The existing surface water discharge permittee, with DENR approval, has upgraded or built new wastewater treatment facilities between March 27, 1973, and July 1, 1988;

☐ The existing surface water discharge permittee discharges to a receiving water assigned only the beneficial uses of (9) and (10); the discharge is not expected to contain toxic pollutants in concentrations that may cause an impact to the receiving stream; and DENR has documented that the stream cannot attain a higher use classification. This exemption does not apply to discharges that may cause impacts to downstream segments that are of higher quality;

☐ Receiving water meets Tier 1 waters criteria. Any permitted discharge must meet water quality standards;

☐ The permitted discharge will be authorized by a Section 404 Corps of Engineers Permit, will undergo a similar review process in the issuance of that permit, and will be issued a 401 certification by the department, indicating compliance with the state's antidegradation provisions; or

☒ Other: This permit does not authorize an increase in effluent limits.

*An antidegradation review is not required where the proposal is to maintain or improve the existing effluent levels and conditions. Proposals for increased effluent levels, in these categories of activities are subject to review.

ANTIDEGRADATION REVIEW SUMMARY

The outcome of the review is:

- ☒ A formal antidegradation review was not required for reasons stated in this worksheet. Any permitted discharge must ensure water quality standards will not be violated.
- ☐ The review has determined that degradation of water quality should not be allowed. Any permitted discharge would have to meet effluent limits or conditions that would not result in any degradation estimated through appropriate modeling techniques based on ambient water quality in the receiving stream, or pursue an alternative to discharging to the waterbody.
- ☐ The review has determined that the discharge will cause an insignificant change in water quality in the receiving stream. The appropriate agency may proceed with permit issuance with the appropriate conditions to ensure water quality standards are met.
- ☐ The review has determined, with public input, that the permitted discharge is allowed to discharge effluent at concentrations determined through a total maximum daily load (TMDL). The TMDL will determine the appropriate effluent limits based on the upstream ambient water quality and the water quality standard(s) of the receiving stream.
- ☐ The review has determined that the discharge is allowed. However, the full assimilative capacity of the receiving stream cannot be used in developing the permit effluent limits or conditions. In this case, a TMDL must be completed based on the upstream ambient water quality and the assimilative capacity allowed by the antidegradation review.
- ☐ Other: _____

Describe any other requirements to implement antidegradation or any special conditions That are required as a result of this antidegradation review: _____

Jonathan Hill	**August 9, 2012**
Reviewer	Date
Kelli D. Buscher, P.E.	**August 9, 2012**
Program Supervisor or Team Leader	Date

ATTACHMENT 2

Monitoring Data

	5-day BOD	TSS	Water Temperature		pH		Oil and grease visual	Coliform, fecal general		Cyanide, weak acid, dissociable		Flow rate		Hardness, total
	DAILY MAX	DAILY MAX	30DAY AVG	DAILY MAX	DAILY MIN	DAILY MAX	DAILY MAX	30DAY GEO	DAILY MAX	30DAY AVG	DAILY MAX	30DAY AVG	DAILY MAX	DAILY MIN
DMR	20 mg/L	30 mg/L	° C	° C	6.5 SU	9 SU	Y=1;N=0	1000 #/100mL	2000 #/100mL	8 ug/L	58.8 ug/L	MGD	MGD	mg/L
04/30/2006	5.6	10	9.83	13	8.07	8.54	0	NR	NR	BD	BD	0.74	1.61	260
05/31/2006	3.7	8.4	14	15	8.09	8.4	0	8	11	BD	BD	0.36	0.38	270
04/30/2007	6.6	10	9.5	12	8.3	8.36	0	NR	NR	BD	BD	0.13	0.16	250
05/31/2007	2.4	4	17.4	19	8.13	8.47	0	4.6	12	BD	BD	0.31	0.38	260
05/31/2008	3.9	5.2	13.6	15	8.24	8.44	0	19.3	24	BD	BD	0.51	0.81	260
06/30/2008	2.5	4	19	19	8.35	8.35	0	18	18	BD	BD	0.38	0.38	270
04/30/2009	2.2	BD	10.33	11	8.34	8.52	0	NR	NR	BD	BD	0.4	0.42	270
05/31/2009	2.1	BD	16	18	8.4	8.56	0	NR	1	BD	BD	0.35	0.42	110
05/31/2010	2.2	BD	18	18	8.26	8.4	0	NR	18	BD	BD	0.5	0.79	280
06/30/2010	4	5.6	20.25	20.5	8.52	8.74	0	NR	7	BD	BD	0.79	0.79	280
10/31/2010	4	9.2	15	15	7.53	7.92	0	NR	NR	5	5	0.92	0.96	240
04/30/2011	5.2	7.2	6.5	8	7.72	7.85	0	NR	NR	9.1*	9.1	0.8	0.84	260
05/31/2011	3.2	10	13.7	17	7.7	7.85	0	NR	4	BD	BD	0.73	0.76	270

BD is Below Detection. Pollutant concentrations were too small to be measured.
NR is Not Required. No sample was required for this parameter during the monitoring period.
*A letter was received with the April, 2011 DMR stating that the WAD cyanide result of 9.1µg/L was caused by nitrates in the agricultural runoff into cell #5.This is considered a weather related result and is not considered a violation.

	Nitrogen, ammonia total (as N)		Chemical Oxygen Demand	Chromium, total recoverable		Phenols	Silver, total recoverable		Cadmium, total recoverable		Zinc, total recoverable	
	30 DAY AVG	DAILY MAX	DAILY MAX	30 DAY AVG	DAILY MAX	DAILY MAX	30DAY AVG	DAILY MAX	30 DAY AVG	DAILY MAX	30 DAY AVG	DAILY MAX
DMR	1.2 mg/L	9.5 mg/L	mg/L	17 ug/L	37.4 ug/L	mg/L	ug/L	10 ug/L	1.7 ug/L	22.4 ug/L	510 ug/L	536.1 ug/L
04/30/2006	0.06	0.1	42	1	1	0.05	0.2	0.2	0.2	0.2	5	5
05/31/2006	0.01	0.01	31	1	1	0.05	0.02	0.02	0.2	0.2	5	5
04/30/2007	0.05	0.08	36	1	1	0.05	0.2	0.2	0.2	0.2	8	8
05/31/2007	0.08	0.14	36	1	1	0.25	0.2	0.2	0.2	0.2	5	5
05/31/2008	0.13	0.24	34	1	1	0.05	0.2	0.2	0.2	0.2	5	5
06/30/2008	0.13	0.13	29	1	1	0.05	0.2	0.2	0.2	0.2	5	5
04/30/2009	0.11	0.12	120	BD	BD	BD	BD	BD	BD	BD	BD	BD
05/31/2009	0.12	0.16	70	BD	BD	BD	BD	BD	BD	BD	BD	BD
05/31/2010	0.15	0.16	64	BD	BD	BD	BD	BD	BD	BD	BD	BD
06/30/2010	0.15	0.16	68	BD	BD	BD	BD	BD	BD	BD	BD	BD
10/31/2010	0.18	0.19	70	1	1	0.05	0.2	0.2	0.2	0.2	5	5
04/30/2011	0.15	0.22	97	2.1	2.1	BD	BD	BD	BD	BD	BD	BD
05/31/2011	0.08	0.08	50	BD	BD	BD	BD	BD	BD	BD	BD	BD

BD is Below Detection. Pollutant concentrations were too small to be measured.

	Static Renewal 96Hr Acute Pimephales Promelas	Static 48Hr Acute Ceriodaphnia
	DAILY MX	**DAILY MX**
DMR	**pass=0/fail=1**	**pass=0/fail=1**
End Date		
06/30/2006	0	0
06/30/2007	0	0
06/30/2008	0	0
06/30/2009	0	0
06/30/2010	0	0
12/31/2010	0	0
06/30/2011	0	0

ATTACHMENT 3

Ammonia Limits Development
for the
USGS EROS Data Center Treatment Facility

in the Unnamed Tributary of West Pipestone Creek
near
Sioux Falls, South Dakota

Prepared by

South Dakota Department of Environment and Natural Resources

2012

INTRODUCTION

Under Section 303(c) of the federal Clean Water Act, states have been required to develop water quality standards to protect public health and enhance water quality. In accordance with the Clean Water Act, the state of South Dakota has assigned beneficial uses to all waters of the state and developed water quality criteria to protect those uses. South Dakota's surface water quality standards and assigned beneficial uses are found in the Administrative Rules of South Dakota (ARSD) Article 74:51.

To ensure the protection of the state's surface water quality standards, the Clean Water Act authorized a permitting program for point source discharges of pollutants. The U.S. Environmental Protection Agency delegated this permitting program to the South Dakota Department of Environment and Natural Resources on December 30, 1993.

The department issues Surface Water Discharge permits containing, at a minimum, technology-based effluent limits. However, these limits are not always adequate to protect South Dakota's water quality. In those cases, the Department of Environment and Natural Resources develops water quality-based effluent limits. In accordance with the procedures and requirements outlined below, water quality-based effluent limits for ammonia will be developed for The National Center for Earth Resources Observation Science (EROS)'s wastewater treatment facility (WWTF). These limits will ensure the surface water quality standards for the unnamed tributary of West Pipestone Creek near Sioux Falls are maintained and protected.

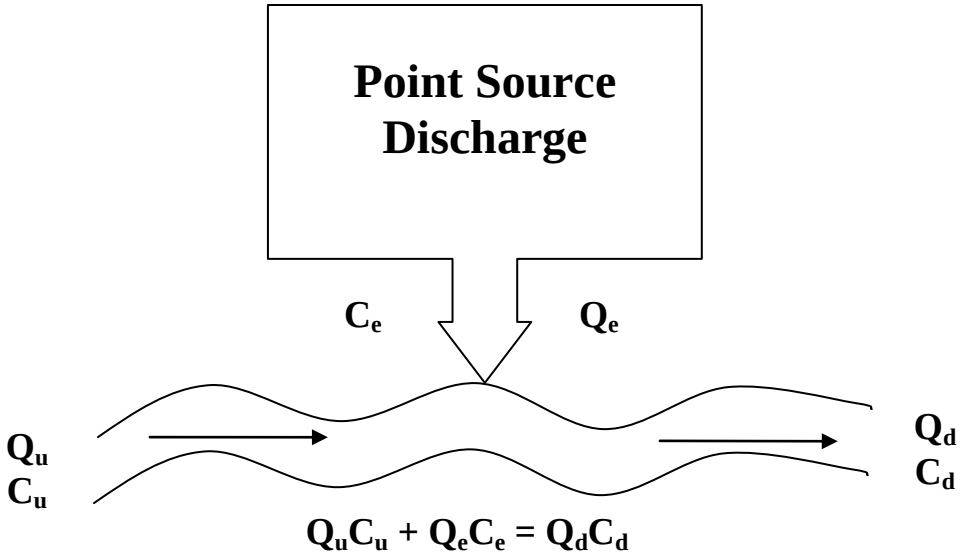
Developing the ammonia limits for EROS is a matter of determining the maximum level of ammonia that can be present in the unnamed tributary of West Pipestone Creek without causing the applicable South Dakota Surface Water Quality Standards (SDSWQS) for ammonia to be exceeded.

The effluent limits for ammonia are developed for critical conditions to be conservative, thereby assuring water quality standards are maintained under less critical conditions. Critical conditions are those at which the surface water quality standards are most likely to be violated. Critical conditions can be defined by several factors, including, but not limited to the following:

- stream flow (e.g., high, low);
- storm event occurrence and intensity;
- ambient water quality conditions (e.g., pH, temperature, etc.);
- diurnal variations in water column conditions;
- temporal occurrence of pollutant loadings from natural and human-induced activities;
- the presence or absence of salmonids; and
- the presence or absence of early life stages of aquatic life.

The following mass balance equation will be used to determine the ammonia limits for EROS:

Figure 1



Where,

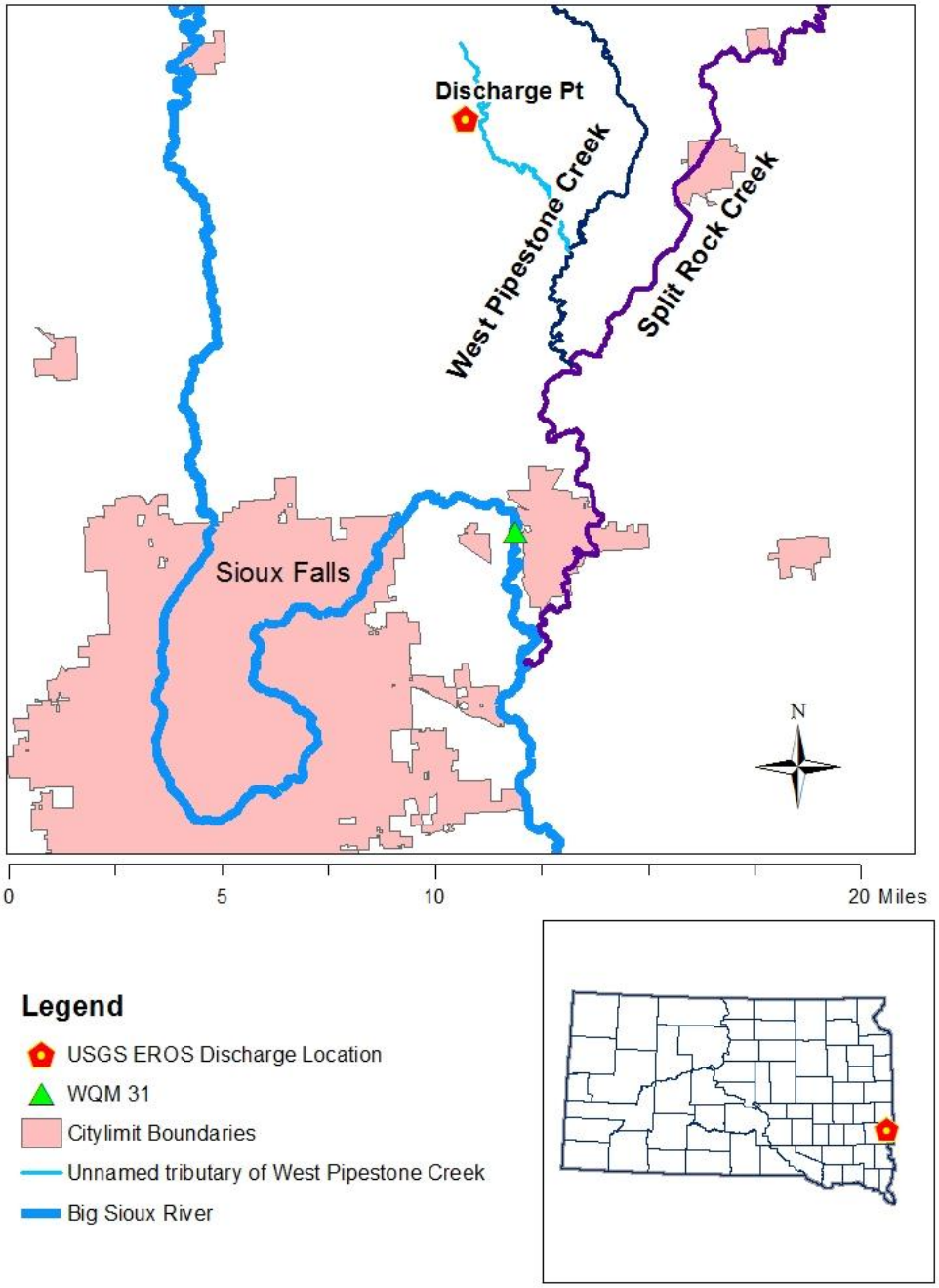
- $\mathbf{Q_u}$ = Receiving stream flow, in cubic feet per second (cfs);
- $\mathbf{C_u}$ = Ambient upstream ammonia concentration, in milligrams per liter (mg/L);
- $\mathbf{Q_e}$ = Effluent discharge flow rate, in cfs;
- $\mathbf{C_e}$ = Water quality based effluent limit for ammonia in mg/L;
- $\mathbf{Q_d}$ = Downstream flow (equal to $Q_u + Q_e$), in cfs; and
- $\mathbf{C_d}$ = Allowable instream ammonia concentration (based on the SD Surface Water Quality Standards), in mg/L.

Using the mass balance equation and the following information, the water quality-based effluent limits for ammonia can be determined for EROS's discharge into the unnamed tributary of West Pipestone Creek.

GEOGRAPHICAL EXTENT

The unnamed tributary of West Pipestone Creek is located in the Big Sioux River Basin in the South Easatern portion of the state. The Big Sioux River Basin drains approximately 5,382 square miles in South Dakota and an additional 3,000 square miles in Minnesota and Iowa. The basin's primary source of income is agriculture, but it also contains a majority of the state's light manufacturing, food processing, and wholesale industries. Four state educational institutions, several vocational schools, and Sioux Falls, the state's largest city, are located within this basin, making this the heaviest populated basin in the state. Figure 2 shows the unnamed tributary of West Pipestone Creek near Sioux Falls.

Figure 2: The Big Sioux Watershed Near The Discharge Location



Past experience has shown that, due to the decay and transformation of organic pollutants such as ammonia, most adverse effects are generally exhibited within 10 miles of pollutant loading. While this rule of thumb can certainly vary depending on the source of the pollutant, fate and transport characteristics, hydrologic conditions, and other factors, it has generally held true in past instances. Therefore, the development of the ammonia limits for EROS's discharge into the unnamed tributary of West Pipestone Creek will be relatively narrow in spatial extent.

ALLOWABLE INSTREAM AMMONIA CONCENTRATION (C_d)

South Dakota Surface Water Quality Standards

The SDSWQS specify the beneficial uses assigned to specific water bodies. The SDSWQS also contain specific narrative and numeric criteria that must be met to ensure the protection of each beneficial use. The unnamed tributary of West Pipestone Creek is classified for the following beneficial uses:

(5) Warmwater semipermanent fish life propagation waters;
(8) Limited-contact recreation waters;
(9) Fish and wildlife propagation, recreation, and stock watering waters; and
(10) Irrigation waters.

Waterbodies designated in the SDSWQS with the beneficial use classification of either coldwater permanent or coldwater marginal fish life propagation are suitable for supporting salmonids. Waterbodies with the beneficial use classifications of warmwater permanent, warmwater semipermanent, or warmwater marginal fish life propagation will likely not have salmonids. The presence or absence of early life stages can be assumed based on the beneficial uses assigned to the receiving stream.

Salmonids are not expected to be present in The unnamed tributary of West Pipestone Creek. Early life stages are expected to be present from March through October based on the SDSWQS (ARSD Section 74:51:01:48).

Allowable Instream Ammonia Levels

Based on the beneficial uses of the unnamed tributary of West Pipestone Creek, the following equations can be used determine the total allowable ammonia concentration in the receiving stream (SDSWQS, ARSD Chapter 74:51:01, Appendix A):

Equation 1: Daily Maximum (Salmonids present)

$$Cd = \frac{0.275}{(1+10^{(7.204-pH)})} + \frac{39.0}{(1+10^{(pH-7.204)})}$$

Equation 2: Daily Maximum (Salmonids NOT present)

$$Cd = \frac{0.411}{(1+10^{(7.204-pH)})} + \frac{58.4}{(1+10^{(pH-7.204)})}$$

Equation 3: 30-day Average (Early Life Stages Present)

$$Cd = \left[\frac{0.0577}{(1+10^{(7.688-pH)})} + \frac{2.487}{(1+10^{(pH-7.688)})} \right] \times MIN\left(2.85, 1.45 \times 10^{0.028(25-T)}\right)$$

Equation 4: 30-day Average (Early Life Stages Absent)

$$Cd = \left[\frac{0.0577}{(1+10^{(7.688-pH)})} + \frac{2.487}{(1+10^{(pH-7.688)})} \right] \times [1.45 \times 10^{0.028((25-MAX(T,7))}]$$

pH = the pH of the water quality sample in standard units
T = the water temperature of the sample in degrees Centigrade
MIN = use either 2.85 or the value of $1.45^{0.028*(25-T)}$, whichever is the smaller value
MAX = use either the water temperature (T) for the sample, or 7, whichever is the greater value

To develop the ammonia limits for EROS, equations 2, 3, and 4 will be used to determine the instream ammonia concentration, C_d, allowed in the unnamed tributary of West Pipestone Creek. C_d will be expressed as both 30-day average and daily maximum concentrations. The monthly limits were developed because of the availability of monthly data.

Instream Water Quality Monitoring

The department maintains a statewide network of fixed monitoring stations to gain a historic record of water quality for various streams around the state. This water quality monitoring (WQM) network consists of 151 monitoring stations, which are sampled at monthly, quarterly, or seasonal intervals. The goal of this sampling is to collect reliable water quality data that reflects actual stream conditions; to collect data to determine the effectiveness of controls on point and nonpoint sources of pollution; and to collect data to evaluate the appropriateness of current beneficial use designations.

Water quality samples are collected at a nearby WQM station on the Big Sioux River because a WQM station is not located on West Pipestone Creek or Split Rock Creek. The data from this WQM station was considered to be similar to the stream quality in the unnamed tributary of West Pipestone Creek for the purposes of this WQBEL. A description of the station is listed below. Figure 2 denotes the location of WQM 31.

WQM 31	At east-west black top road bridge, approximately 1 mile downstream of Brandon WWTF, 0.9 mile south and 1.3 miles west of I-90 Brandon exit.

Ambient temperature, pH, and ammonia data at WQM 31 were obtained to represent instream conditions for the unnamed tributary of West Pipestone Creek. The water quality information obtained from WQM 31 is presented in Attachment 4. The pH and temperature data are summarized in Table 1 below.

Calculation of Allowable Instream Ammonia Concentration (C_d)

The SDSWQS specify the total ammonia concentration that is allowed at a given pH and temperature. Using BPJ, the 50th percentile of the pH and temperature was used because the Big Sioux, at the WQM, location has a larger volume of water and is influenced by sources that will not be influencing the discharge location. This information was used to calculate the allowable

instream ammonia concentrations for each month. Table 1 summarizes the allowable instream ammonia (C_d) for the unnamed tributary of West Pipestone Creek.

Table 1: Allowable Instream Total Ammonia Concentrations for the unnamed tributary of West Pipestone Creek

Month	Temperature (°C)	pH (s.u.)	C_d, Allowable Total Ammonia (mg/L)	
			30-Day Average	Daily Maximum
January	1.00	8.00	3.95	8.41
February	1.67	7.95	4.24	9.23
March	5.00	8.00	2.43	8.41
April	13.00	8.20	1.79	5.73
May	17.39	8.20	1.49	5.73
June	23.89	8.00	1.24	7.65
July	26.50	8.15	0.90	6.31
August	24.47	8.33	0.76	4.45
September	17.78	8.24	1.36	5.30
October	12.00	8.15	1.94	6.31
November	5.60	8.20	2.91	5.73
December	1.11	7.95	4.24	9.23

AMBIENT AMMONIA CONCENTRATION (C_u)

The ammonia data at WQM 31 was reviewed to determine the ambient water quality in the unnamed tributary of West Pipestone Creek. Using BPJ, the 50th percentile of the ammonia was used because the Big Sioux, at the WQM, is influenced by sources that will not be influencing the discharge location. The ammonia data from WQM 31 is presented in Attachment 4. Table 2 below summarizes the 50^{th} percentile ammonia data for each Month. This data represents the ambient ammonia concentration for the unnamed tributary of West Pipestone Creek (C_u).

Table 2: Ambient Ammonia Data for the unnamed tributary of West Pipestone Creek

Month	Ammonia (mg/L)
January	0.06
February	0.09
March	0.16
April	0.02
May	0.02
June	0.02
July	0.02
August	0.02
September	0.02

Month	Ammonia (mg/L)
October	0.02
November	0.03
December	0.02

EFFLUENT DISCHARGE FLOW RATE (Q_e)

The effluent discharge flow rate, Q_e, can be determined in several different ways. If effluent data is available for the discharger, the 50th or 80th percentile of the daily flow can be used. The effluent design flow rate of the wastewater treatment facility may be used as the expected effluent flow rate in the absence of actual discharge data. Alternatively, for stabilization pond systems, it may be appropriate to develop an effluent flow rate based on expected performance.

For the purposes of developing ammonia limits for EROS, 1.25 cfs was used for Q_e based on the 80th percentile of the daily maximum flow to ensure the ammonia standards are maintained during critical conditions. See Attachment 5 for more details.

Table 3 below summarizes the effluent flow rate used in these calculations.

RECEIVING STREAM FLOW (Q_u)

The United States Geological Survey (USGS) maintains hundreds of flow monitoring sites in South Dakota. The receiving stream flow rate, Q_u, is determined from an analysis of stream flow data available, incorporating the flow considerations required by *South Dakota's Mixing Zone and Dilution Implementation Procedures*.

Critical conditions for ammonia presumably occur when stream flows are relatively low. Therefore, the ammonia limits will be developed for low stream flow conditions. Should it be determined that water quality standards are violated at other flow conditions, the permit would be reopened and new limits would be developed.

ARSD Section 74:51:01:30 specifies that surface water quality standards apply to low quality fishery waters when flows meet or exceed the minimum 7-day average low flow that can be expected to occur once every 5years (7Q5), or 1.0 cfs, whichever is greater. The 7Q5 is therefore the minimum, or critical, flow for which the SDSWQS must be maintained, although all Surface Water Discharge permit limits remain in force below this minimum flow.

There are no flow monitoring stations on the unnamed tributary of West Pipestone Creek. A 7Q5 of 1.0 cfs was assumed for the unnamed tributary of West Pipestone Creek (ARSD Section 74:51:01:30).

South Dakota's water quality standards allow a zone of mixing for discharges. In accordance with the SDSWQS, chronic water quality criteria must be met at the end of the mixing zone; the acute criteria must be met at all times within the mixing zone. The mixing zone is therefore a limited portion of a water body where mixing of the effluent and receiving stream is in progress, but not complete. In some cases, the discharge will not completely mix with the entire receiving

stream. There are many factors that influence the rate of mixing in a stream. A few of these factors are the flow and velocity of the receiving stream, the flow and velocity of the effluent, the slope of the stream, and other stream characteristics.

The *South Dakota Mixing Zone and Dilution Implementation Procedures* outlines an approach for modeling the mixing zone. Using these procedures, the 7Q5 is adjusted to account for the allowable ratio of flow available in the receiving stream. This adjusted flow represents the receiving stream flow rate (Q_u).

Table 3 summarizes the flow data and the determination of Q_u for the unnamed tributary of West Pipestone Creek.

Table 3: Critical Low Flow Values for the unnamed tributary of West Pipestone Creek

Month	7Q5 Low Flow (cfs)	Effluent Flow (cfs)	Ratio of Effluent to 7Q5	Allowable Ratio of 7Q5	Critical Low Flow Q_u (cfs)
January	1.00	1.25	1.25	1.00	1.00
February	1.00	1.25	1.25	1.00	1.00
March	1.00	1.25	1.25	1.00	1.00
April	1.00	1.25	1.25	1.00	1.00
May	1.00	1.25	1.25	1.00	1.00
June	1.00	1.25	1.25	1.00	1.00
July	1.00	1.25	1.25	1.00	1.00
August	1.00	1.25	1.25	1.00	1.00
September	1.00	1.25	1.25	1.00	1.00
October	1.00	1.25	1.25	1.00	1.00
November	1.00	1.25	1.25	1.00	1.00
December	1.00	1.25	1.25	1.00	1.00

DOWNSTREAM FLOW RATE (Q_d)

The downstream flow rate, Q_d, is simply the sum of the upstream flow rate (Q_u) and the effluent flow rate (Q_e). The downstream flow rate used for the calculation of the ammonia limits for EROS's discharge into the unnamed tributary of West Pipestone Creek is summarized in Table 4 below.

CALCULATION OF AMMONIA LIMIT (C_e)

Each of the variables determined above is summarized in Table 4. Using the mass balance equation, the ammonia limits for EROS's discharge into the unnamed tributary of West Pipestone Creek can be calculated as follows:

$$Ce = \frac{(Qd * Cd) - (Qu * Cu)}{Qe}$$

The water quality-based effluent limits for ammonia for EROS's discharge into the unnamed tributary of West Pipestone Creek are presented in Table 4.

Table 4: Variables Calculated for Mass Balance Equation

Month	C_u, mg/L	C_d, mg/L		Q_e, cfs	Q_d, cfs	C_e, mg/L	
		30-day Average	Daily Maximum			30-Day Average	Daily Maximum
January	0.06	3.95	8.41	1.25	2.25	7.1	15.1
February	0.09	4.24	9.23	1.25	2.25	7.6	16.5
March	0.16	2.43	8.41	1.25	2.25	4.2	15.0
April	0.02	1.79	5.73	1.25	2.25	3.2	10.3
May	0.02	1.49	5.73	1.25	2.25	2.7	10.3
June	0.02	1.24	7.65	1.25	2.25	2.2	13.8
July	0.02	0.90	6.31	1.25	2.25	1.6	11.3
August	0.02	0.76	4.45	1.25	2.25	1.4	8.0
September	0.02	1.36	5.30	1.25	2.25	2.4	9.5
October	0.02	1.94	6.31	1.25	2.25	3.5	11.3
November	0.03	2.91	5.73	1.25	2.25	5.2	10.3
December	0.02	4.24	9.23	1.25	2.25	7.6	16.6

EROS's current permit contains ammonia limits. The current effluent limits were compared to the limits calculated using the information presented above. A comparison of the two limits is presented in Table 5 below.

During the months of January, February, May, June, July, August, September, October and December, EROS's current 30-day limit was adequate to protect the beneficial use and the water quality criteria for the unnamed tributary of West Pipestone Creek. During the months of January, February, March, May, June, July, September, October and December, EROS's current Daily Maximum limit was adequate to protect the beneficial use and the water quality criteria for the unnamed tributary of West Pipestone Creek. These limits will be continued in the proposed permit, to prevent backsliding. During the remaining months, it was necessary to establish more stringent limits. The shaded values in Table 5 indicate the limits that will be proposed for EROS.

Table 5: Comparison of Current and Proposed Effluent Limits

Month	Current Effluent Limits		Calculated Effluent Limits	
	30-Day Average (mg/L)	Daily Maximum (mg/L)	30-Day Average (mg/L)	Daily Maximum (mg/L)
January	***5.6***	***12.6***	7.1	15.1
February	***5.6***	***12.6***	7.6	16.5
March	5.6	***12.6***	***4.2***	15.0
April	5.6	12.6	***3.2***	***10.3***
May	***1.2***	***9.5***	2.7	10.3
June	***1.2***	***9.5***	2.2	13.8
July	***1.2***	***9.5***	1.6	11.3
August	***1.2***	9.5	1.4	***8.0***
September	***1.2***	***9.5***	2.4	9.5
October	***1.2***	***9.5***	3.5	11.3
November	5.6	12.6	***5.2***	***10.3***
December	***5.6***	***12.6***	7.6	16.6

ATTACHMENT 4

Water Quality Data

WQM 31 Raw Data

January

Sample Date	Ammonia (mg/L)	Ammonia (mg/L) Used in calculations	Temperature, water °C	pH
01/15/75	No data	No data	0.00	7.7
01/27/76	No data	No data	0.00	7.69
01/28/76	No data	No data	0.00	7.68
01/29/76	No data	No data	0.00	7.5
01/17/77	No data	No data	0.00	7.74
01/10/78	No data	No data	0.00	7.2
01/11/78	No data	No data	0.00	7.1
01/24/79	No data	No data	0.00	7.5
01/07/80	No data	No data	0.00	8.2
01/26/81	No data	No data	0.56	8.14
01/24/84	No data	No data	0.56	7.6
01/28/85	No data	No data	0.00	7.75
01/27/86	No data	No data	0.00	7.8
01/27/87	No data	No data	0.00	8.25
01/18/88	No data	No data	1.11	7.95
01/31/89	No data	No data	1.10	8.45
01/22/90	No data	No data	2.22	7.3
01/30/91	No data	No data	1.10	8.0
01/27/92	No data	No data	3.40	8.03
01/25/94	No data	No data	1.11	7.88
01/30/95	No data	No data	2.78	8.34
01/24/96	0.07	0.07	1.11	8.14
01/22/97	0.3	0.3	1.67	7.88
01/28/98	non-detect	0.02	1.67	8.26
01/27/99	0.04	0.04	0.90	8.11
01/31/00	0.03	0.03	0.00	7.96
01/09/01	0.06	0.06	4.60	8.18
01/09/02	0.1	0.1	3.00	8.06
01/29/03	No data	No data	1.00	8.1
01/12/04	non-detect	0.02	6.00	8.1
01/11/05	0.05	0.05	1.00	8.1
01/25/06	non-detect	0.02	2.00	8.3
01/08/07	0.12	0.12	1.00	8.11
01/07/08	<0.02	0.02	3.00	8.2
01/21/09	0.11	0.11	1.00	8.0
01/12/10	0.12	0.12	1.00	7.3
01/18/11	0.09	0.09	1.00	No data
01/04/12	<0.05	0.05	2.00	7.8
80th percentile		0.11	2.00	8.17
50th percentile		***0.06***	***1.00***	***8.00***
average		0.08	1.21	7.90

If the lab reported “Non-detect”, a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.02” a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.05” a value of 0.05 was assumed in the calculations. No value was used during months with “no data”.

February

Sample Date	Ammonia (mg/L)	Ammonia (mg/L) Used in calculations	Temperature, water °C	pH
02/10/75	No data	No data	0.00	7.5
02/18/76	No data	No data	3.33	7.5
02/07/77	No data	No data	0.00	7.72
02/21/78	No data	No data	0.00	6.7
02/27/79	No data	No data	1.11	7.9
02/26/80	No data	No data	0.00	7.7
02/23/81	No data	No data	1.67	7.8
02/27/84	No data	No data	1.67	7.65
02/26/85	No data	No data	0.00	8.3
02/24/86	No data	No data	0.00	7.9
02/23/87	No data	No data	0.00	8.2
02/22/88	No data	No data	5.56	8.08
02/27/89	No data	No data	2.20	7.95
02/20/90	No data	No data	1.67	8.65
02/20/91	No data	No data	1.67	8.0
02/24/92	No data	No data	2.00	7.91
02/22/93	No data	No data	0.56	8.17
02/15/94	No data	No data	2.78	8.34
02/27/95	No data	No data	1.67	8.29
02/26/96	0.3	0.3	1.11	8.28
02/18/97	0.26	0.26	1.67	8.0
02/24/98	0.73	0.73	2.22	7.9
02/23/99	0.07	0.07	0.90	8.26
02/23/00	0.06	0.06	7.80	8.12
02/22/01	0.09	0.09	1.10	7.96
02/26/02	0.08	0.08	1.00	8.17
02/18/03	Non-detect	0.02	5.00	8.2
02/11/04	0.14	0.14	2.00	7.9
02/14/05	0.18	0.18	3.00	7.9
02/13/06	Non-detect	0.02	2.00	8.3
02/20/07	0.58	0.58	6.00	7.9
02/19/08	0.04	0.04	No data	7.94
02/10/09	0.7	0.7	2.00	7.9
02/16/10	0.91	0.91	2.00	8.1
02/07/11	0.09	0.09	1.00	7.8
01/04/12	<0.05	0.05	2.00	7.8
80th percentile		0.52	2.33	8.20
50th percentile		**0.09**	**1.67**	**7.95**
average		0.25	1.91	7.96

If the lab reported “Non-detect”, a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.05” a value of 0.05 was assumed in the calculations. No value was used during months with “no data”.

March

Sample Date	Ammonia (mg/L)	Ammonia (mg/L) Used in calculations	Temperature, water °C	pH
03/18/75	No data	No data	0.00	7.5
03/09/76	No data	No data	0.56	7.95
03/10/76	No data	No data	0.00	8.0
03/11/76	No data	No data	0.00	7.95
03/07/77	No data	No data	1.11	6.4
03/28/78	No data	No data	5.56	7.0
03/26/79	No data	No data	1.67	8.0
03/25/80	No data	No data	2.78	6.7
03/23/81	No data	No data	8.89	8.5
03/26/81	No data	No data	7.22	7.1
03/26/84	No data	No data	0.00	7.75
03/25/85	No data	No data	7.00	7.92
03/24/86	No data	No data	5.00	7.65
03/23/87	No data	No data	7.20	8.15
03/28/88	No data	No data	7.22	7.95
03/27/89	No data	No data	5.50	7.13
03/28/90	No data	No data	8.33	9.1
03/23/92	No data	No data	8.20	7.98
03/23/93	No data	No data	5.56	8.23
03/28/94	No data	No data	5.56	8.18
03/27/95	No data	No data	6.67	8.1
03/18/96	0.3	0.3	2.78	7.92
03/18/97	0.32	0.32	4.44	7.66
03/18/98	0.08	0.08	1.11	8.12
03/18/99	0.08	0.08	5.10	8.43
03/31/00	Non-detect	0.02	13.50	8.72
03/28/01	1.39	1.39	6.80	8.02
03/25/02	Non-detect	0.02	2.00	8.38
03/19/03	0.44	0.44	4.00	8.2
03/29/04	Non-detect	0.02	10.00	8.5
03/21/05	Non-detect	0.02	3.00	8.4
03/27/06	0.1	0.1	6.00	8.3
03/19/07	0.85	0.85	4.00	7.8
03/24/08	0.39	0.39	3.00	8.3
03/16/09	<0.05	0.05	6.00	8.2
03/22/10	0.22	0.22	4.00	7.9
03/14/11	0.36	0.36	2.00	7.9
80th percentile		0.39	7.16	8.30
50th percentile		***0.16***	***5.00***	***8.00***
average		0.29	4.64	7.95

If the lab reported “Non-detect”, a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.05” a value of 0.05 was assumed in the calculations. No value was used during months with “no data”.

April

Sample Date	Ammonia (mg/L)	Ammonia (mg/L) Used in calculations	Temperature, water °C	pH
04/15/75	No data	No data	1.70	7.5
04/07/76	No data	No data	6.67	8.0
04/05/77	No data	No data	2.22	8.5
04/26/78	No data	No data	11.70	8.0
04/24/79	No data	No data	16.70	8.1
04/28/80	No data	No data	16.70	8.3
04/27/81	No data	No data	20.60	7.8
04/27/82	No data	No data	12.22	8.9
04/18/83	No data	No data	4.44	8.06
04/23/84	No data	No data	11.10	7.85
04/30/85	No data	No data	17.00	8.25
04/28/86	No data	No data	10.00	8.23
04/27/87	No data	No data	15.60	8.5
04/26/88	No data	No data	8.33	8.77
04/25/89	No data	No data	17.80	7.95
04/23/90	No data	No data	18.30	7.45
04/23/91	No data	No data	14.40	8.63
04/20/92	No data	No data	6.50	8.76
04/26/93	No data	No data	14.40	8.48
04/25/94	No data	No data	19.44	8.28
04/24/95	No data	No data	12.22	7.84
04/22/96	Non-detect	0.02	13.89	8.48
04/29/97	Non-detect	0.02	15.00	8.3
04/27/98	0.03	0.03	15.56	8.2
04/13/99	Non-detect	0.02	16.50	8.09
04/27/00	Non-detect	0.02	15.50	8.2
04/26/01	0.03	0.03	13.00	8.01
04/09/02	0.28	0.28	9.00	8.04
04/17/03	Non-detect	0.02	15.00	8.1
04/12/04	Non-detect	0.02	11.00	8.1
04/11/05	0.16	0.16	14.00	8.1
04/10/06	Non-detect	0.02	14.00	8.2
04/11/07	<0.02	0.02	3.00	8.2
04/14/08	<0.02	0.02	8.00	8.5
04/13/09	<0.05	0.05	10.00	8.4
04/12/10	<0.05	0.05	13.00	8.4
04/11/11	<0.05	0.05	10.00	8.2
80th percentile		0.05	16.32	8.48
50th percentile		***0.02***	***13.00***	***8.20***
average		0.05	12.28	8.21

If the lab reported “Non-detect”, a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.02” a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.05” a value of 0.05 was assumed in the calculations. No value was used during months with “no data”.

May

Sample Date	Ammonia (mg/L)	Ammonia (mg/L) Used in calculations	Temperature, water °C	pH
05/06/75	No data	No data	15.50	8.0
05/04/76	No data	No data	14.40	8.0
05/10/77	No data	No data	16.70	8.0
05/24/78	No data	No data	20.00	8.0
05/27/80	No data	No data	20.60	7.9
05/26/81	No data	No data	16.70	8.0
05/25/82	No data	No data	15.56	8.1
05/23/83	No data	No data	18.90	8.5
05/21/84	No data	No data	21.00	8.45
05/27/85	No data	No data	23.00	8.35
05/26/86	No data	No data	17.00	7.95
05/18/87	No data	No data	20.00	8.25
05/24/88	No data	No data	19.40	8.56
05/22/89	No data	No data	21.10	7.75
05/21/90	No data	No data	16.10	8.25
05/20/91	No data	No data	17.80	8.13
05/18/92	No data	No data	15.60	8.45
05/17/93	No data	No data	17.80	8.16
05/16/94	No data	No data	21.11	8.63
05/22/95	No data	No data	17.78	8.09
05/28/96	0.04	0.04	14.44	8.28
05/27/97	0.02	0.02	15.00	8.07
05/26/98	No data	No data	28.33	8.28
05/18/99	Non-detect	0.02	17.00	8.2
05/31/00	Non-detect	0.02	20.60	8.52
05/21/01	Non-detect	0.02	16.50	8.24
05/14/02	Non-detect	0.02	13.00	8.06
05/13/03	Non-detect	0.02	17.00	No data
05/19/04	Non-detect	0.02	18.00	8.3
05/16/05	Non-detect	0.02	16.00	8.6
05/08/06	Non-detect	0.02	16.00	8.4
05/14/07	<0.02	0.02	21.00	8.2
05/19/08	<0.02	0.02	18.00	8.3
05/04/09	<0.05	0.05	15.00	8.4
05/17/10	<0.05	0.05	17.00	8.2
05/09/11	<0.05	0.05	18.00	8.2
80th percentile		0.04	20.60	8.41
50th percentile		***0.02***	***17.39***	***8.20***
average		0.03	17.97	8.22

If the lab reported “Non-detect”, a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.02” a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.05” a value of 0.05 was assumed in the calculations. No value was used during months with “no data”.

June

Sample Date	Ammonia (mg/L)	Ammonia (mg/L) Used in calculations	Temperature, water °C	pH
06/11/75	No data	No data	16.10	8.0
06/08/76	No data	No data	22.20	8.0
06/07/77	No data	No data	20.00	8.0
06/28/78	No data	No data	26.70	7.7
06/06/79	No data	No data	25.00	7.8
06/27/79	No data	No data	26.10	9.1
06/23/80	No data	No data	24.40	8.3
06/22/81	No data	No data	18.90	7.7
06/28/82	No data	No data	26.67	7.9
06/27/83	No data	No data	24.40	7.95
06/24/85	No data	No data	30.00	8.45
06/23/86	No data	No data	23.00	7.8
06/22/87	No data	No data	28.00	8.45
06/29/88	No data	No data	26.10	8.09
06/26/89	No data	No data	18.90	8.05
06/27/90	No data	No data	26.70	7.9
06/26/91	No data	No data	25.60	8.26
06/22/92	No data	No data	24.60	7.96
06/21/93	No data	No data	22.80	8.04
06/21/94	No data	No data	23.89	7.85
06/26/95	No data	No data	23.89	7.86
06/24/96	Non-detect	0.02	27.22	7.87
06/23/97	Non-detect	0.02	27.78	8.11
06/09/98	non-detect	0.02	18.33	8.22
06/15/99	Non-detect	0.02	17.30	8.14
06/28/00	Non-detect	0.02	24.00	8.57
06/18/01	0.03	0.03	22.50	8.05
06/11/02	Non-detect	0.02	26.00	8.52
06/09/03	Non-detect	0.02	23.00	8.7
06/15/04	Non-detect	0.02	25.00	8.4
06/13/05	Non-detect	0.02	21.00	8.2
06/12/06	<0.02	0.02	22.00	8.8
06/04/07	<0.02	0.02	20.00	8.3
06/16/08	<0.02	0.02	21.00	8.3
06/22/09	<0.05	0.05	29.00	8.6
06/14/10	<0.05	0.05	19.00	8.0
06/13/11	<0.05	0.05	19.00	8.0
80th percentile		0.03	26.55	8.44
50th percentile		***0.02***	***23.89***	***8.05***
average		0.03	23.41	8.16

If the lab reported “Non-detect”, a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.02” a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.05” a value of 0.05 was assumed in the calculations. No value was used during months with “no data”.

July

Sample Date	Ammonia (mg/L)	Ammonia (mg/L) Used in calculations	Temperature, water °C	pH
07/15/74	No data	No data	24.00	7.79
07/08/75	No data	No data	No data	8.0
07/07/76	No data	No data	23.30	7.5
07/05/77	No data	No data	24.40	8.0
07/31/78	No data	No data	25.00	8.2
07/25/79	No data	No data	28.30	7.9
07/28/80	No data	No data	25.56	8.3
07/25/83	No data	No data	25.60	8.15
07/23/84	No data	No data	27.00	8.05
07/29/85	No data	No data	24.00	8.55
07/28/86	No data	No data	28.00	8.2
07/22/87	No data	No data	30.00	8.65
07/24/89	No data	No data	26.70	7.9
07/24/90	No data	No data	24.40	7.85
07/22/91	No data	No data	29.40	8.46
07/27/92	No data	No data	No data	8.37
07/26/93	No data	No data	24.40	8.1
07/26/94	No data	No data	25.00	8.12
07/24/96	Non-detect	0.02	26.11	8.29
07/27/97	Non-detect	0.02	28.89	8.28
07/14/98	non-detect	0.02	31.67	8.64
07/27/99	Non-detect	0.02	28.00	7.91
07/31/00	Non-detect	0.02	3.70	8.57
07/18/01	Non-detect	0.02	26.50	8.07
07/23/01	0.14	0.14	27.00	8.13
07/10/02	0.43	0.43	26.50	7.05
07/07/03	Non-detect	0.02	26.00	8.5
07/12/04	Non-detect	0.02	29.00	8.4
07/20/05	Non-detect	0.02	29.00	7.9
07/17/06	<0.02	0.02	29.00	9.0
07/09/07	<0.02	0.02	29.00	8.8
07/14/08	<0.02	0.02	27.00	8.6
07/20/09	<0.05	0.05	22.00	8.3
07/12/10	<0.05	0.05	26.00	8.1
07/11/11	<0.05	0.05	27.00	7.9
80th percentile		0.05	28.96	8.51
50th percentile		***0.02***	***26.50***	***8.15***
average		0.06	25.98	8.19

If the lab reported “Non-detect”, a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.02” a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.05” a value of 0.05 was assumed in the calculations. No value was used during months with “no data”.

August

Sample Date	Ammonia (mg/L)	Ammonia (mg/L) Used in calculations	Temperature, water °C	pH
08/04/74	No data	No data	16.00	7.5
08/05/75	No data	No data	23.30	7.5
08/03/76	No data	No data	22.20	8.0
08/02/77	No data	No data	22.20	8.0
08/23/78	No data	No data	28.30	8.0
08/24/78	No data	No data	27.80	7.7
08/28/79	No data	No data	24.40	8.0
08/27/80	No data	No data	20.60	7.8
08/22/83	No data	No data	26.10	8.55
08/27/84	No data	No data	27.00	8.5
08/26/85	No data	No data	21.00	8.35
08/25/86	No data	No data	24.00	8.25
08/25/87	No data	No data	15.00	8.21
08/15/88	No data	No data	33.90	8.88
08/21/89	No data	No data	23.30	7.35
08/22/90	No data	No data	17.20	8.42
08/30/91	No data	No data	23.30	8.78
08/24/92	No data	No data	19.40	8.1
08/23/93	No data	No data	25.90	8.41
08/22/94	No data	No data	24.44	8.36
08/21/95	No data	No data	26.80	8.33
08/20/96	Non-detect	0.02	28.33	8.39
08/26/97	Non-detect	0.02	28.33	8.33
08/20/98	non-detect	0.02	27.78	8.17
08/16/00	Non-detect	0.02	22.30	8.26
08/20/01	Non-detect	0.02	23.50	8.7
08/05/02	0.17	0.17	24.50	7.6
08/18/03	Non-detect	0.02	28.00	8.8
08/09/04	Non-detect	0.02	23.00	8.5
08/30/05	Non-detect	0.02	26.00	8.9
08/14/06	<0.02	0.02	28.00	8.7
08/15/07	<0.02	0.02	28.00	8.7
08/11/08	<0.02	0.02	24.00	8.4
08/10/09	<0.05	0.05	28.00	8.9
08/11/10	<0.05	0.05	27.00	8.1
08/01/11	<0.05	0.05	29.00	8.2
80th percentile		0.05	28.00	8.70
50th percentile		***0.02***	***24.47***	***8.33***
average		0.04	24.66	8.27

If the lab reported “Non-detect”, a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.02” a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.05” a value of 0.05 was assumed in the calculations. No value was used during months with “no data”.

September

Sample Date	Ammonia (mg/L)	Ammonia (mg/L) Used in calculations	Temperature, water °C	pH
09/17/74	No data	No data	16.00	7.5
09/09/75	No data	No data	16.10	8.0
09/10/75	No data	No data	21.10	7.5
09/11/75	No data	No data	17.70	7.5
09/08/76	No data	No data	18.90	7.5
09/06/77	No data	No data	20.00	7.5
09/24/79	No data	No data	16.70	8.1
09/29/80	No data	No data	16.10	7.8
09/26/83	No data	No data	15.60	8.05
09/24/84	No data	No data	7.00	7.9
09/23/85	No data	No data	13.00	8.4
09/22/86	No data	No data	18.00	7.7
09/29/87	No data	No data	17.00	8.35
09/27/88	No data	No data	20.00	8.69
09/25/89	No data	No data	16.70	8.0
09/24/90	No data	No data	14.40	8.0
09/24/91	No data	No data	11.70	8.5
09/21/92	No data	No data	21.20	8.23
09/27/93	No data	No data	14.40	8.37
09/26/94	No data	No data	17.78	8.37
09/25/95	No data	No data	15.30	8.3
09/16/96	Non-detect	0.02	22.22	8.49
09/23/97	Non-detect	0.02	17.22	8.24
09/24/98	Non-detect	0.02	19.50	6.62
09/27/99	Non-detect	0.02	16.30	6.78
09/12/00	Non-detect	0.02	15.60	8.49
09/11/01	Non-detect	0.02	23.00	8.61
09/04/02	Non-detect	0.02	23.00	8.49
09/16/03	Non-detect	0.02	24.00	8.6
09/01/04	Non-detect	0.02	27.00	8.0
09/19/05	Non-detect	0.02	21.00	8.9
09/25/06	<0.02	0.02	17.00	8.7
09/17/07	<0.02	0.02	22.00	8.4
09/22/08	<0.02	0.02	23.00	8.7
09/08/09	<0.05	0.05	26.00	8.7
09/07/10	<0.05	0.05	18.00	8.0
09/12/11	<0.05	0.05	24.00	8.6
80th percentile		0.02	22.18	8.58
50th percentile		***0.02***	***17.78***	***8.24***
average		0.03	18.47	8.12

If the lab reported “Non-detect”, a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.02” a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.05” a value of 0.05 was assumed in the calculations. No value was used during months with “no data”.

October

Sample Date	Ammonia (mg/L)	Ammonia (mg/L) Used in calculations	Temperature, water °C	pH
10/08/75	No data	No data	11.10	7.5
10/05/76	No data	No data	12.20	7.5
10/27/77	No data	No data	11.70	7.7
10/04/78	No data	No data	13.89	7.6
10/23/78	No data	No data	10.56	7.8
10/29/79	No data	No data	11.10	7.9
10/27/80	No data	No data	5.00	7.74
10/24/83	No data	No data	10.00	7.75
10/22/84	No data	No data	4.00	7.65
10/21/85	No data	No data	11.00	8.15
10/27/86	No data	No data	13.90	8.15
10/26/87	No data	No data	11.00	8.5
10/23/89	No data	No data	10.00	7.05
10/24/90	No data	No data	4.44	8.9
10/22/91	No data	No data	14.40	8.72
10/27/92	No data	No data	13.30	8.49
10/25/93	No data	No data	13.33	8.56
10/24/94	No data	No data	10.56	8.47
10/29/96	0.04	0.04	13.33	8.18
10/21/97	Non-detect	0.02	12.78	8.56
10/27/98	Non-detect	0.02	14.40	8.02
10/29/99	Non-detect	0.02	10.80	6.97
10/26/00	0.05	0.05	18.90	7.63
10/17/01	0.02	0.02	10.00	8.55
10/07/03	Non-detect	0.02	20.00	8.3
10/05/04	Non-detect	0.02	18.00	8.8
10/11/05	No data	No data	11.00	8.2
10/10/06	<0.02	0.02	14.00	8.6
10/09/07	<0.02	0.02	17.00	8.6
10/14/08	<0.02	0.02	13.00	8.4
10/19/09	<0.05	0.05	11.00	8.1
10/12/10	<0.05	0.05	17.00	8.0
10/17/11	<0.05	0.05	12.00	8.5
80th percentile		0.05	14.24	8.56
50th percentile		***0.02***	***12.00***	***8.15***
average		0.03	12.26	8.11

If the lab reported “Non-detect”, a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.02” a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.05” a value of 0.05 was assumed in the calculations. No value was used during months with “no data”.

November

Sample Date	Ammonia (mg/L)	Ammonia (mg/L) Used in calculations	Temperature, water °C	pH
11/06/74	No data	No data	7.00	7.8
11/05/75	No data	No data	10.00	7.5
11/02/76	No data	No data	7.78	7.5
11/28/77	No data	No data	0.56	7.9
11/19/79	No data	No data	5.60	8.2
11/30/81	No data	No data	3.33	7.5
11/26/84	No data	No data	No data	8.15
11/25/85	No data	No data	0.00	8.25
11/17/86	No data	No data	0.56	8.05
11/16/87	No data	No data	7.78	8.8
11/21/88	No data	No data	3.30	8.4
11/20/89	No data	No data	5.56	7.4
11/28/90	No data	No data	2.22	8.4
11/19/91	No data	No data	5.00	8.31
11/16/92	No data	No data	6.11	8.28
11/15/93	No data	No data	3.89	8.15
11/28/94	No data	No data	2.78	8.12
11/01/95	No data	No data	5.00	8.27
11/28/95	No data	No data	1.67	8.2
11/25/96	0.13	0.13	2.22	8.37
11/04/97	Non-detect	0.02	No data	No data
11/18/98	Non-detect	0.02	3.00	7.51
11/17/99	Non-detect	0.02	8.80	7.24
11/28/00	0.03	0.03	6.20	7.25
11/20/01	Non-detect	0.02	7.50	8.63
11/13/02	0.03	0.03	8.00	8.76
11/20/03	0.18	0.18	9.00	8.7
11/09/04	Non-detect	0.02	11.00	8.6
11/29/05	Non-detect	0.02	2.00	8.2
11/06/06	0.03	0.03	9.00	8.6
11/05/07	<0.02	0.02	7.00	8.4
11/17/08	<0.02	0.02	3.00	8.3
11/16/09	<0.05	0.05	6.00	7.4
11/09/10	<0.05	0.05	8.00	8.0
11/07/11	<0.05	0.05	7.00	8.4
80th percentile		0.05	7.91	8.40
50th percentile		***0.03***	***5.60***	***8.20***
average		0.04	5.33	8.10

If the lab reported “Non-detect”, a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.02” a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.05” a value of 0.05 was assumed in the calculations. No value was used during months with “no data”.

December

Sample Date	Ammonia (mg/L)	Ammonia (mg/L) Used in calculations	Temperature, water °C	pH
12/09/74	No data	No data	0.00	7.7
12/02/75	No data	No data	0.00	7.5
12/07/76	No data	No data	0.00	7.88
12/28/77	No data	No data	2.78	8
12/04/78	No data	No data	1.11	7.4
12/18/78	No data	No data	1.11	7.6
12/03/79	No data	No data	0.56	5.9
12/22/80	No data	No data	1.11	7.6
12/27/83	No data	No data	0.00	7.5
12/17/84	No data	No data	1.00	7.85
12/16/85	No data	No data	0.00	7.75
12/29/86	No data	No data	0.00	8.25
12/28/87	No data	No data	0.56	8.05
12/19/89	No data	No data	-0.56	7.8
12/17/90	No data	No data	1.67	8.21
12/17/91	No data	No data	1.00	7.9
12/14/92	No data	No data	3.33	8.16
12/14/93	No data	No data	2.22	8.21
12/12/94	No data	No data	1.67	7.99
12/12/95	No data	No data	0.56	8.25
12/16/96	0.13	0.13	1.67	7.91
12/16/97	Non-detect	0.02	No data	No data
12/15/98	Non-detect	0.02	2.00	8.39
12/16/98	Non-detect	0.02	2.00	8.45
12/09/99	Non-detect	0.02	4.00	7.24
12/16/99		No data	2.00	8.45
12/05/00	Non-detect	0.02	2.50	7.55
12/11/01	0.23	0.23	3.00	8.26
12/24/02	Non-detect	0.02	1.00	8.4
12/10/03	Non-detect	0.02	1.00	8.3
12/07/04	Non-detect	0.02	4.00	No data
12/13/05	0.08	0.08	2.00	8.3
12/13/06	<0.02	0.02	3.00	8.5
12/03/07	<0.02	0.02	1.00	8.4
12/16/08	<0.02	0.02	1.00	7.8
12/15/09	<0.05	0.05	1.00	7.0
12/06/10	<0.05	0.05	1.00	8.0
12/12/11	<0.05	0.05	2.00	7.8
80th percentile		0.05	2.18	8.30
50th percentile		***0.02***	***1.11***	***7.95***
average		0.05	1.41	7.90

If the lab reported “Non-detect”, a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.02” a value of 0.02 was assumed in the calculations. If the lab reported a value of “<0.05” a value of 0.05 was assumed in the calculations. No value was used during months with “no data”.

ATTACHMENT 5

Point Source Dischargers Flow Rate

	Maximum Daily Flow (MGD)	Maximum Daily Flow (cfs)
04/30/2006	0.53	0.82
05/31/2006	0.45	0.70
04/30/2007	0.41	0.63
05/31/2007	0.41	0.63
05/31/2008	1.61	2.49
06/30/2008	0.38	0.59
04/30/2009	0.16	0.25
05/31/2009	0.38	0.59
05/31/2010	0.81	1.25
06/30/2010	0.38	0.59
10/31/2010	0.42	0.65
04/30/2011	0.42	0.65
05/31/2011	0.79	1.22
04/30/2006	0.79	1.22
05/31/2006	0.96	1.49
04/30/2007	0.84	1.30
05/31/2007	0.76	1.18
80th percentile	***0.81***	***1.25***
50th percentile	0.45	0.70
average	0.62	0.96

Note: 1.00 MGD equals 1.547 cfs

ATTACHMENT 6

Reasonable Potential Analysis

Reasonable Potential Analysis for Chronic Metals Toxicity
USGS EROS data center
June 12, 2012
South Dakota Department of Environment and Natural Resources

	Pollutant[6]				
Date	Cadmium, total recoverable ug/L	Chromium, total recoverable ug/L	Cyanide, weak acid, dissociable ug/L	Silver, total recoverable ug/L	Zinc, total recoverable ug/L
04/30/2006	0.20	1.00	5.00	0.20	5.00
05/31/2006	0.20	1.00	5.00	0.20	5.00
04/30/2007	0.20	1.00	5.00	0.20	5.00
05/31/2007	0.20	1.00	5.00	0.20	5.00
05/31/2008	0.20	1.00	5.00	0.20	5.00
06/30/2008	0.20	1.00	5.00	0.20	5.00
04/30/2009	0.20	1.00	5.00	0.20	5.00
05/31/2009	0.20	1.00	5.00	0.20	5.00
05/31/2010	0.20	1.00	5.00	0.20	5.00
06/30/2010	0.20	1.00	5.00	0.20	5.00
10/31/2010	0.20	1.00	5.00	0.20	5.00
04/30/2011	0.20	2.10	9.10	0.20	5.00
05/31/2011	0.20	1.00	5.00	0.20	5.00
n	13	13	13	13	13
Mean	0.20	1.08	5.32	0.20	5.00
Variance	0.00	0.09	1.29	0.00	0.00
Std. Dev.	0.00	0.31	1.14	0.00	0.00
Maximum	0.20	2.10	9.10	0.20	5.00
Coefficient of Variation [1]	0.00	0.28	0.21	0.00	0.00
Dilution factor [2]	1.00	1.00	1.00	1.00	1.00
Multiplying factor [3]	1.00	1.26	1.19	1.00	1.00
Hardness	252.31	252.31	252.31	252.31	252.31
Highest Reasonable Potential Concentration [4]	0.20	2.64	10.83	0.20	5.00
SDSWQ Standard [5]	0.47	11.00	5.20	15.80	258.79
	OK	OK	Reasonable Potential	OK	OK

[1] The coefficient of variation where n>10 is calculated as standard deviation/mean. When n<10, the coefficient of variation is estimated to be 0.6.

[2] Because the receiving water flow used in the rest of the calculations in this document was assumed to be 1 cfs and the reasonable assumption that no dilution is present, the dilution factor was assumed to be 1 for these calculations.

[3] The multiplying factor is computed in accordance with EPA's reasonable potential determination, pages 56-57, Technical Support Document for Water Quality-based Toxics Control, March 1991.

[4] The maximum observed effluent concentration is multiplied by this multiplying factor to determine the highest effluent concentration which can reasonably be expected, based on the observed data, a 99% confidence level, and a 95% probability basis.

[5] The standards are based on the dissolved portion of metals. However, to be conservative, the reasonable potential analysis is based on the total recoverable portion of the metals. Any effluent limits developed in response to this analysis will also be based on total recoverable metals. (See ARSD 74:52:03:16). The Chromium standard is based on the hexavalent chromium standard (Cr VI).

[6] Pollutants measured at non-detect levels were assumed to be present at the level of detection.

Reasonable Potential Analysis for Acute Metals Toxicity
USGS EROS data center
June 12, 2012
South Dakota Department of Environment and Natural Resources

	Pollutant[6]			
Date	**Cadmium, total recoverable ug/L**	**Chromium, total recoverable ug/L**	**Silver total recoverable ug/L**	**Zinc, total recoverable ug/L**
04/30/2006	0.20	1.00	0.20	5.00
05/31/2006	0.20	1.00	0.20	5.00
04/30/2007	0.20	1.00	0.20	5.00
05/31/2007	0.20	1.00	0.20	5.00
05/31/2008	0.20	1.00	0.20	5.00
06/30/2008	0.20	1.00	0.20	5.00
04/30/2009	0.20	1.00	0.20	5.00
05/31/2009	0.20	1.00	0.20	5.00
05/31/2010	0.20	1.00	0.20	5.00
06/30/2010	0.20	1.00	0.20	5.00
10/31/2010	0.20	1.00	0.20	5.00
04/30/2011	0.20	2.10	0.20	5.00
05/31/2011	0.20	1.00	0.20	5.00
n	13	13	13	13
Mean	0.20	1.08	0.20	5.00
Variance	0.00	0.09	0.00	0.00
Std. Dev.	0.00	0.31	0.00	0.00
Maximum	0.20	2.10	0.20	5.00
Coefficient of Variation [1]	0.00	0.28	0.00	0.00
Dilution factor [2]	1.00	1.00	1.00	1.00
Multiplying factor [3]	1.00	1.26	1.00	1.00
Hardness	252.31	252.31	252.31	252.31
Highest Reasonable [4] Potential Concentration	0.20	2.64	0.20	5.00
SDSWQ Standard [5]	4.95	16.00	15.80	256.69
	OK	OK	OK	OK

[1] The coefficient of variation where n>10 is calculated as standard deviation/mean. When n<10, the coefficient of variation is estimated to be 0.6.

[2] Because the receiving water flow used in the rest of the calculations in this document was assumed to be 1 cfs and the reasonable assumption that no dilution is present, the dilution factor was assumed to be 1 for these calculations.

[3] The multiplying factor is computed in accordance with EPA's reasonable potential determination, pages 56-57, Technical Support Document for Water Quality-based Toxics Control, March 1991.

[4] The maximum observed effluent concentration is multiplied by this multiplying factor to determine the highest effluent concentration which can reasonably be expected, based on the observed data, a 99% confidence level, and a 95% probability basis.

[5] The standards are based on the dissolved portion of metals. However, to be conservative, the reasonable potential analysis is based on the total recoverable portion of the metals. Any effluent limits developed in response to this analysis will also be based on total recoverable metals. (See ARSD 74:52:03:16). The Chromium standard is based on the hexavalent chromium standard (Cr VI).

[6] Pollutants measured at non-detect levels were assumed to be present at the level of detection.